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YELLOWSTONE RIVER STUDY

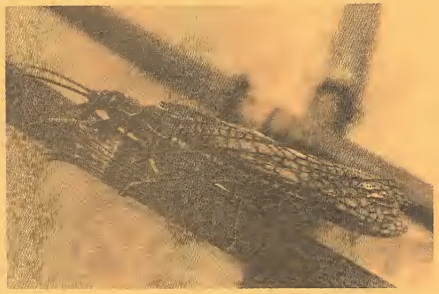
ANNUAL PROGRESS REPORT

RESEARCH CONDUCTED BY:

MONTANA DEPARTMENT OF FISH AND GAME

AND

TENNECO INC.



PREPARED BY:

ROBERT L. NEWELL
AQUATIC ECOLOGIST

AUGUST 1975

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Yellowstone River study annual progress
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OBJECTIVES - PHASE I

This study was initiated in August, 1974 and actual sampling of aquatic macroinvertebrates began in November. Initial research objectives were to inventory the invertebrates, determine longitudinal distribution patterns and examine the quality of the fauna utilizing species diversity indices. Once this information has been obtained, research on flow requirements and ecology of the dominant organisms can proceed.

It was decided early in the study that it would be desirable to study the entire river as a continuous ecosystem. Data gathered from all parts of the river could aid in the understanding of the faunal distribution at any one station.

METHODS - PHASE I

Twenty sampling stations were established along the Yellowstone River in Montana (Table 1) and each was sampled monthly except during severe ice conditions (January - March) and peak runoff months (May - June). Stations 1 - 4 were sampled by Rod Berg (Fish and Game funding), stations 5 - 11 by Dennis Schwehr (University of Montana, Old West Reg. Comm. funding) and stations 12 - 20 by Robert Newell (Tenneco, Inc. funding).

Initial inventory sampling was accomplished by means of Hester - Dendy multiple plate artificial substrates (E.P.A. 1973). These samplers were modified by placing larger spacers between the plates and by inserting a longer center rod. This center rod with attached plates was thrust into the substratum with the lowermost plate 2" from the bottom. Fluctuating water levels and thick, unstable ice conditions destroyed some samplers and forced their temporary removal during the winter and high water period.

Additional monthly inventory sampling was accomplished with 2 min. kick samples. This type of sampling ensures collection of most of the fauna. Data gathered from kick samples can be used in diversity calculations, percent composition and comparisons between stations.

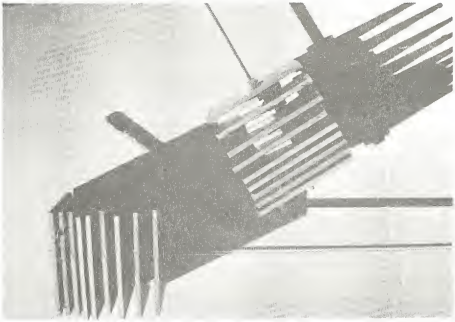
All organisms collected from the Yellowstone River were identified to genus, counted and the data were sent to the State Data Processing Bureau where several species diversity indicies were calculated. Invertebrates collected from the Tongue River were identified to genus but were not counted.

Species diversity indices were calculated using the following formulas:

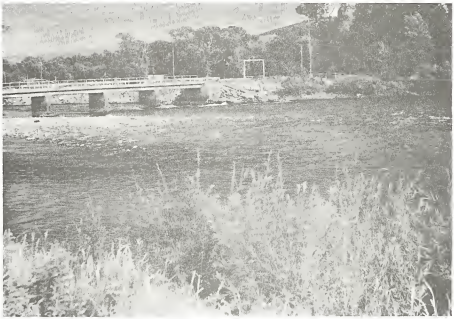
Shannon-Weaver function $(\bar{d}) = -\sum_{i=1}^{s} (N_i/N) \log_2 (Ni/N)$

(Shannon and Weaver 1964)

Equitability $(E_m) = \bar{d}/dmax$
(Margalef 1957, Krebs 1972)



Hester-Dendy multiple plate artificial substrates



Yellowstone River at Livingston

Table 1. Yellowstone River Sampling Stations

No.	Location	County	Elevation	River Mile**
1	Corwin Springs	Park	5110 ft.	549
2	Mallard Rest Access	Park	4620	515
3	Above Livingston	Park	4490	502
4	Above Shields River	Park	4380	497
5	Grey Bear Access	Sweetgrass	4100	468
6	Below Greycliff	Sweetgrass	3880	444
7	Columbus	Stillwater	3566	411
8	Laurel	Yellowstone	3294	391
9	Duck Creek Bridge	Yellowstone	3140	360
10	Huntley	Yellowstone	3110	349
11	Custer	Yellowstone	2720	300
12	Bighorn River	Treasure	2700	296
13	Myers	Treasure	2640	279
14	Forsyth	Rosebud	2490	234
15	Miles City	Custer	2335	184
16	Terry	Prairie	2190	138
17	Glendive	Dawson	2045	93
18	Intake	Dawson	1998	71
19	Sidney	Richland	1892	30
20	Cartwright, N.D.	McKenzie	1850	9

** Mouth of the Yellowstone River is river mile 0.0.

Redundancy (R) = $\frac{dmax - \bar{d}}{dmax - dmin}$

(Wilhm and Dorris 1966, 1968)

Theor. Max. diversity (d_{max}) = $(^1/N)\left[\log_2 N! - S\log_2 (N/S)!\right]$

Theor. Min. diversity (d_{min}) = $(^1/N)\left\{\log_2 N! - \log_2 \left[N-(S-1)\right]!\right\}$

Evenness (J') = $\bar{d}/\log_2 S$
(Pielow 1969, Egloff and Brakel 1973)

Species Richness (SR) = $\bar{d} - \bar{d}/\log_2 N$
(Orr et al. 1973)

where: S = number of species
Ni = number of individuals in the ith SPECIES
N = total number of individuals

A high (>3.0) Shannon-Weaver index generally means a healthy community while a low index (<1.0) generally means the community is under some type of stress (Wilhm 1970 abc), (Table 2).

Equitability has been found to be very sensitive to even slight levels of degradation. Healthy communities have values of 0.0 to 0.3 (E.P.A. 1973).

Redundancy is a measure of the repetition of information within a community and thereby expresses the dominance of one or more species and is inversely proportional to the wealth of species. Redundancy is maximal when no choice of species exists and minimal when there is a large choice of species.

Community distribution has maximum evenness if all the species abundances are equal and the greater the disparities among the different species abundances, the smaller the evenness.

Species richness is a little used index that shows maximal values with large numbers of species.

Much of the benthic fauna can presently be identified only to the genus level. Once the fauna has been identified to species a search of published literature will provide some insight into ecological requirements and tolerances. Adult insects permit positive identification to the species level and therefore adult collection has and will continue to receive strong emphasis during this study.

PRELIMINARY RESULTS - PHASE I

Several interesting patterns of longitudinal distribution occur in the 550 miles of Yellowstone River examined in this study. The Ephemeroptera (mayflies) exhibit some distinct patterns of distribution (Table 3). The mayfly community is composed of several species confined to the upper river, several species found only in the lower river and 4 species found throughout the river. Individuals of the genera Baetis, Ephemerella and Rhithrogena were the most numerous. The Ephemeroptera comprised a mean of 44 percent of the fauna and percent composition ranged from 11-88 percent (Table 9). About 75% of the mayflies have been identified to species.

The Trichoptera (caddisflies) decrease in diversity as one proceeds downstream (Table 4). The majority of the fauna is confined to the upper 9 stations. The genera Cheumatopsyche and Hydropsyche were the most abundant caddisflies collected and were also the most widespread. Trichoptera comprised an average of 16 percent of the fauna and percent composition ranged from 0-58 percent of the fauna (Table 9). Approximately 20 percent of the species have been identified .

The Plecoptera (stoneflies) decrease in diversity in a downstream direction (Table 5). A total of 29 species representing 14 genera were collected. Most of the species (25) were found in the upper river and only 4 species were confined to the lower 10 sampling stations, including several species not previously known from east of the continental divide: Brachyptera pacifica, B. fosketti, Isogenus frontalis colubrinus and Acroneuria abnormis. Stoneflies comprised a mean of 6 percent (range 0-15 percent) of the fauna, (Table 9). About 95 percent of the species have been identified.

The Diptera of the Yellowstone are dominated by the family Chironomidae (midges), where 19 genera have been tentatively identified, and were very abundant throughout the river (Table 6). The Diptera comprised a mean of 33 percent of the total fauna (range 4-78 percent) (Table 9).

The miscellaneous orders found in the river (Table 7) comprised a minor portion of the invertebrate fauna (mean of 1 percent, range 0-11 percent) (Table 9). Very few species have been identified.

A checklist of the fauna of the Yellowstone and Tongue River is presented in Table 8. An attempt was made to identify as many species as possible. In some cases, adults were collected and positive identification was possible. In other cases, the most probable species for a particular genus was tentatively placed on the list, and a question mark appears after the species which has been placed in parentheses.

Species diversity values are presented in Table 2. Only 5 months of data have been analyzed to date, but it appears that none of the sampling stations are under any excessive environmental stress. Shannon-Weaver index values ($\bar{d}$) range from 1.53 to 3.84. No distinct patterns of indices are evident throughout the river system. Further interpretation with the limited number of samples is not warranted at this time.

OBJECTIVES - PHASE II

The second phase of this study will begin in July, 1975. The major emphasis will involve determination of flow requirements of the dominant macroinvertebrates approximately 50 miles above and below the Intake diversion. Emphasis will be to determine distribution and abundance of invertebrates in relation to current, depth and substratum.

METHODS - PHASE II

Since emergence of species occurs throughout the summer and fall, a large number of samples will be taken during each sampling period. Analysis of results will be made with data gathered at each sampling period and little comparison

will be possible between samples taken at different intervals of time (e.g. all July samples will be analyzed together with little analysis between July and August samples). Samples will be taken monthly from July through December, 1975.

Sampling stations will be established near Terry, immediately above and below Intake and at Sidney. Less frequent sampling will occur at Glendive and near the mouth of the Yellowstone River. Each sampling period will involve a minimum of 20 approximately one foot samples taken along transects perpendicular to current flow. Current velocity and water depth will be determined at each sample location. Abundance and presence or absence will each be plotted against depth and against current speed. If sufficient data are available an analysis of variance will be calculated to determine the influence of each variable.

The influence of different substratum types and flow rates will be investigated during this winter of 1975 - 1976 using facilities at the Miles City fish hatchery. Examination of results obtained from these two investigations should provide insight into flow requirements of the major benthic organisms in the lower Yellowstone.

Research will also continue to determine a quantitative sampling method that will be acceptable on the Yellowstone River. Adult collections will also be continued and experts will be consulted for identification of the more difficult taxa.

FORAGE FISH INVESTIGATIONS - PHASE I

The maintenance of the piscivorous sport and nonsport species fish populations of the lower Yellowstone depends on an adequate forage fish base. A forage fish is any fish that is utilized as a source of food by other fish.

Most members of the Cyprinidae (minnow) family found in the lower Yellowstone are probably used as forage to some extent. Other species, such as the stonecat, are commonly found in fish stomachs. In addition, age 0 fish of both sport and nonsport fish species may also be used as forage by adult fish. The objectives of the forage fish investigations are to: 1) collect and identify those fish species which may be utilized as a food source by other fish, and 2) identify the habitat requirements of the important forage fish species. A food habits study, currently being initiated under the Bureau of Reclamation Yellowstone Study, will identify those forage fish species important to the major sport and nonsport fish populations.

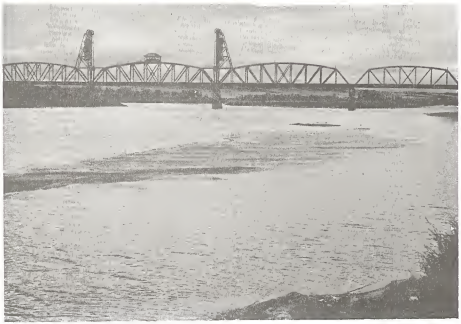
Forage fish samples were taken in the vicinities of Forsyth, Miles City, and Glendive during the fall of 1974. The initial objectives of this sampling were to obtain a reference collection of forage fish species and their distribution and to develop effective sampling techniques for forage species. Any attempt to determine relative abundance of forage fish species between areas depends on development of a standard unit of capture effort. If a standard unit of capture effort can be developed, then forage fish sampling sites will be established and sampled on a regular basis.

Several sampling techniques were tested during this report period for the capture of forage fish species and age 0 sport fish species. A 100-foot, 1/4-inch mesh, 8-foot deep seine is most effective in backwater areas for most forage and age 0 sport species. Certain species, such as the stonecat, are found in areas unsuitable for seining. In these cases, electrofishing with a mobile electrode and half-pulsed DC current will be used.

The 100-foot, 1/4-inch mesh seine will be used in those areas of the main channel which are suitable for seining. In areas of the main channel too deep or swift for seining, electrofishing with the boom electrode and DC current will be used.

Forage fish samples have not been sorted and identified. Analyses of samples will be done during high water and included in the next report.

Yellowstone at Glendive



Yellowstone at mouth

Table 2. Species Diversity Indices

Sta.	$\bar{d}$ (Max.)	Max. Theoretical Diversity Min.	Max.	Min. Theoretical Diversity Min.	Max.	Redundancy Min.	Max.	Evenness Min.	Max.	Equitability Min.	Max.	Richness Min.	Max.
1	2.39	3.82	4.82	0.19	0.42	0.15	0.55	0.48	0.85	0.21	0.36	1.65	2.84
2	3.11	3.22	4.33	0.11	0.54	0.25	0.35	0.66	0.81	0.26	0.39	2.17	2.74
3	2.70	3.24	3.89	0.08	0.42	0.19	0.45	0.56	0.81	0.20	0.37	1.96	2.33
4	2.72	3.52	3.67	0.16	0.61	0.24	0.47	0.57	0.76	0.26	0.33	1.82	2.43
5	3.19	3.37	4.56	0.25	0.49	0.19	0.32	0.69	0.85	0.32	0.40	2.42	2.84
6	2.97	3.61	4.48	0.22	0.50	0.36	0.44	0.57	0.69	0.27	0.34	2.09	2.66
7	3.60	3.29	4.72	0.39	0.73	0.23	0.29	0.75	0.76	0.36	0.43	2.28	3.19
8	3.84	2.85	4.28	0.78	0.98	0.12	0.24	0.79	0.87	0.43	0.53	1.94	3.34
9	3.12	3.58	4.55	0.42	0.84	0.35	0.40	0.66	0.70	0.33	0.39	2.10	2.76
10	3.20	2.83	4.25	0.17	1.13	0.13	0.82	0.22	0.82	0.09	0.51	0.77	2.69
11	2.21	3.74	4.47	0.18	0.53	0.45	0.62	0.41	0.60	0.18	0.28	1.64	1.95
12	2.74	3.13	4.12	0.30	1.00	0.33	0.36	0.66	0.70	0.30	0.42	2.01	2.43
13	1.53	4.44		0.13		0.67		0.34		0.14		1.39	
14	2.94	4.17		0.63		0.35		0.67		0.37		2.57	
15	1.75	4.01		0.28		0.60		0.44		0.20		1.56	
16	-	-		-		-		-		-		-	
17	1.90	2.82		0.39		0.38		0.68		0.28		1.62	
18	2.84	3.91		0.73		0.34		0.69		0.39		2.45	
19	2.41	2.97		0.66		0.24		0.76		0.39		2.02	
20	3.36	3.96		1.04		0.21		0.84		0.51		2.84	

Table 3. Longitudinal Distribution of the Ephemeroptera of the Yellowstone River.

TAXA	STATIONS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Baetis (propinquus)?.....	x																			
Ephemerella hecuba		x																		
E. Heterocaudata		x																		
E. hystrix	x	x																		
Epeorus albertae		x																		
Epeorus longimanus	x	x																		
Ephemerella doddsi	x	x	x	x	x	x														
Ephemerella tibialis.....	x	x	x	x																
Ephemerella grandis	x	x	x	x	x	x														
Paraleptophlebia ... heteronea	x	x	x	x	x	x	x													
Ameletus (oregonensis)?...	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
Ephemerella margarita	x	x	x	x	x	x	x													
Ephemerella inermis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Baetis (alexanderi)?.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Baetis parvus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Heptagenia elegantula.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rhithrogena hageni	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Tricorythodes minutus				x	x	x	x	x	x	x	x	x	x	x						
Leptophlebia (gravastella)?.....			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Traverella albertana.....							x	x	x	x	x	x	x	x	x	x	x	x	x	x
Stenonema sp.										x	x	x	x	x	x	x	x	x		
Choroterpes ..... (albiannulata)?.....										x	x	x	x	x	x	x	x	x		
Baetisca sp.																x				
Dactylobaetis (cepheus)?..																	x	x	x	x
Ephoron album																	x	x	x	x
Lachlania powelli																		x		
Ametropus (neavei)?																				x
Brachycercus (prudens)?...																				x
Isonychia ..... (sicca campestris)?....																				x

Table 4. Longitudinal Distribution of Trichoptera of the Yellowstone River.

TAXA	STATIONS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Amiocentrus aspilus ..		x																		
Rhyacophila sp.....	x	x	x	x	x															
Glossosoma sp.	x	x	x	x	x	x	x	x												
Glossosoma velona.....						x														
Psychomyia sp.....	x	x	x	x	x	x	x													
Athripsodes sp.....	x	x	x	x	x	x	x	x												
Lepidostoma sp.....	x	x	x	x	x	x	x	x	x											
Arctopsyche grandis ..	x	x	x	x	x	x	x	x	x											
Brachycentrus sp.....	x	x	x	x	x	x	x	x	x											
Oecetis sp.....						x			x											
Oecetis disjuncta													x							
Hydroptila sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Cheumatopsyche sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Cheumatopsyche enonis.										x	x	x	x	x	x					
Hydropsyche sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H. occidentalis	x												x							
H. separata																		x		
Polycentropus sp.....													x							
Ochrotrichia potomas..													x							
Leptocella sp.....													x				x	x		
Neotrichia sp.....																	x			

Diversion at Intake

Table 5. Longitudinal Distribution of Plecoptera of the Yellowstone River.

TAXA	STATIONS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Paraleuctra sara	x																			
Pteronarcys californica.....	x	x	x	x	x															
Arcynopteryx parallela...	x	x	x	x	x	x	x	x												
Hesperoperla pacifica ...	x	x	x	x	x	x	x	x												
Isocapnia missourii.....		x	x	x	x	x	x	x												
Isocapnia vedderensis....	x	x	x	x	x	x														
Nemoura besametsa.....	x	x																		
Nemoura cinctipes.....	x	x	x	x	x	x	x	x												
Claassenia sabulosa.....		x	x	x	x	x	x	x	x											
Pteronarcella badia.....	x	x	x	x	x	x	x	x	x	x										
Alloperla spp.....	x	x	x	x	x	x	x	x	x	x	x	x								
Alloperla signata.....	x	x	x	x	x															
Alloperla pallidula.....	x	x	x	x	x	x	x	x												
Alloperla coloradensis..						x														
Capnia spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
Capnia distincta.....	x																			
Capnia confusa.....	x	x	x	x	x															
Capnia gracilaria.....	x	x																		
Capnia poda.....	x	x	x	x	x															
Capnia limata.....								x	x	x	x	x	x	x	x					
Brachyptera spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
B. nigripennis		x	x	x	x	x	x	x												
B. pacifica.....													x	x						
B. fosketti.....															x	x	x	x		
Isoperla spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Isoperla patricia.....	x	x	x	x	x	x	x	x												
Isoperla mormona.....		x	x	x	x	x	x													
Isoperla longiseta.....							x													
Isogenus spp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Isogenus aestivalis.....	x																			
Isogenus tostonus.....	x	x	x	x	x	x	x	x												
Isogenus elongatus.....		x	x	x	x	x	x	x												
Isogenus frontalis.....															x	x	x	x		
Acroneuria abnormis.....															x					

Table 6. Distribution of the Diptera of the Yellowstone River.

TAXA	STATIONS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BLEPHAROCERIDAE																				
Agathon sp.	x																			
CERATOPOGONIDAE													x	x			x			
CHIRONOMIDAE																				
Orthocladius sp.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Cardiocladius sp.	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
Diamesa sp.	x	x	x	x	x	x	x	x												
Metriocnemus sp.		x																		
Procladius sp.			x																	
Pseudodiamesa sp.							x	x												
Chironomus sp.								x												
Cricotopus sp.									x											
Ablabesmyia sp.		x		x							x	x						x	x	
Microtendipes sp.		x	x				x	x	x		x	x								
Rheotanytarsus sp.	x								x		x			x						
Eukiefferiella sp.	x					x	x	x	x	x	x	x	x	x	x	x	x			
Brillia sp.						x				x	x	x						x		
Tribelos sp.				x				x	x					x						
Clinotanypus sp.												x						x		
Cryptochironomus sp.														x						
Cryptocladius sp.													x					x		
Paralauterborniella						x														
Trichocladius sp.																x	x			
																	x			
EMPIDIDAE																				
Hemerodromia sp.	x	x	x	x				x			x									
RHAGIONIDAE																				
Atherix variegata	x	x	x	x	x	x	x	x	x	x										
SIMULIIDAE																				
Simulium sp.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TANYDERIDAE																				
Protoplasa fitchii				x																
TIPULIDAE																				
Dicranota sp.													x		x					
Hexatoma sp.	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
Holorusia sp.			x																	
Tipula sp.									x											

Table 7. Distribution of the Miscellaneous Orders of the Yellowstone River.

TAXA	STATIONS																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ISOPODA																				
Asellus racovitzai .										x										
LEPIDOPTERA																				
Cataclysta sp.....						x							x							
HEMIPTERA																				
Ambrysis mormon.....												x								
Hesperocorixa sp....								x	x	x	x	x	x	x						x
OLIGOCHAETA												x	x	x			x	x		
MOLLUSCA																				
Ferrissia sp.....																	x	x		
Gyraulus sp.....																				x
Physa sp.....							x			x										
ODONATA																				
Gomphus sp.....																				x
Amphiagrion sp.....									x											
COLEOPTERA																				
Hydroporus sp.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x			
Gyrinus sp.....							x													
Microcylloepus sp...					x	x	x	x												
Dubiraphia sp.....															x					
Stenelmis sp.....															x		x			
Optioservus sp.....	x				x	x	x	x				x								
Zaitzevia sp.....					x															
ACARI	x	x	x	x																

Table 8. Checklist of the Aquatic Macroinvertebrates of the Tongue River and Yellowstone River.

Phylum Arthropoda
- Order Ephemeroptera
  - Family Siphlonuridae
    - Ameletus (oregonensis McD.) ?
    - Isonychia (sicca campestris McD.) ?
  - Family Baetidae
    - Baetis (alexanderi M.S. Edmunds and Jensen, sp.nov.) ?
    - " parvus Dodds
    - " (propinquus Walsh) ?
    - Dactylobaetis (cepheus Traver & Edmunds) ?
  - Family Oligoneuriidae
    - Lachlania (powelli Edmunds) ?
  - Family Heptageniidae
    - Epeorus (Iron) albertae (McD.)
    - " (") longimanus (Eaton)
    - Heptagenia elegantula (Eaton)
    - Rhithrogena hageni Eaton
    - Stenonema sp.A
  - Family Ametropodidae
    - Ametropus (neavei McD.) ?
  - Family Leptophlebiidae
    - Choroterpes (albiannulata McD.) ?
    - Leptophlebia (gravastella Eaton) ?
    - Paraleptophlebia heteronea (McD.)
    - Traverella albertana (McD.)
  - Family Ephemerellidae
    - Ephemerella (Attenuatella) margarita Needham
    - " (Caudatella) heterocaudata heterocaudata McD.
    - " (") hystrix Traver
    - " (Drunella) doddsi Needham
    - " (") grandis grandis Eaton
    - " (Ephemerella) inermis Eaton
    - " (Serratella) tibialis McD.
    - " (Timpanoga) hecuba hecuba (Eaton)
  - Family Tricorythidae
    - Tricorythodes minutus Traver
  - Family Polymitarcidae
    - Ephoron album (Say)
  - Family Caenidae
    - Brachycercus (prudens McD.) ?
  - Family Baetiscidae
    - Baetisca sp.A
- Order Trichoptera
  - Family Rhyacophilidae
    - Rhyacophila sp.A

Table 8 Continued

Family Glossosomatidae
Glossosoma sp.A
" velona Ross
Family Psychomyiidae
Polycentropus sp.A
Psychomyia sp.A
Family Hydropsychidae
Arctopsyche grandis (Banks)
Cheumatopsyche sp.A
" enonis Ross
Hydropsyche sp.A
" occidentalis Banks
" separata Banks
Family Hydroptilidae
Hydroptila sp.A
Ochrotrichia potomas Denning
Neotrichia sp.A
Family Leptoceridae
Athripsodes sp.A
Leptocella sp.A
Oecetis sp.A
Oecetis disjuncta (Banks)
Family Lepidostomatidae
Lepidostoma sp.A
Family Brachycentridae
Amiocentrus aspilus (Ross)
Brachycentrus sp.A

Order Plecoptera
Family Nemouridae
Nemoura (Prostoia) besametsa Ricker
" (Zapada) cinctipes Banks
Paraleuctra sara Claassen
Capnia (Capnia) confusa Claassen
" (") gracilaria "
" (") limata Frison
" (Utacapnia) distincta Frison
" (") poda Nebeker & Gaufin
Isocapnia missourii Ricker
" vederensis (Ricker)
Brachyptera (Taenionema) fosketti Ricker
" (") nigripennis (Banks)
" (") pacifica (Banks)
Family Pteronarcidae
Pteronarcella badia (Hagen)
Pteronarcys californica Newport
Family Perlodidae
Arcynopteryx (Skwala) parallela (Frison)
Isogenus (Cultus) aestivalis (Needham & Claassen)
" (") tostonus Ricker
" (Isogenoides) frontalis colubrinus Hagen

Table 8 Continued

Isoperla mormona Banks
" longiseta Banks
" patricia Frison
Family Chloroperlidae
Alloperla (Suwallia) pallidula (Banks)
" (Sweltsa) coloradensis (Banks)
" (Triznaka) signata (Banks)
Family Perlidae
Acroneuria abnormis Newm.
" (Hesperoperla) pacifica Banks
Claassenia sabulosa (Banks)

Order Isopoda
Family Asellidae
Asellus racovitzai racovitzai Williams

Order Lepidoptera
Family Pyralidae
Cataclysta sp.A

Order Hemiptera
Family Corixidae
Hesperocorixa sp.A
Family Naucoridae
Ambrysis mormon Mont.
Family Veliidae
Rhagovelia sp.A

Order Odonata
Family Gomphidae
Gomphus sp.A
Ophiogomphus sp.A
Family Agrionidae
Calopteryx sp.A
Family Coenagrionidae
Argia sp.A
Amphiagrion sp.A
Enallagma sp.A
Ischnura sp.A

Order Coleoptera
Family Dytiscidae
Hydroporus sp.A
Family Elmidae
Dubiraphia sp.A
Microcylloepus pusillus (LeConte)
Optioservus quadrimaculatus (Horn)
Stenelmis sp.A
Zaitzevia parvula (Horn)
Family Gyrinidae
Gyrinus sp.A

Table 8 Continued

Order Diptera
- Family Blepharoceridae
  - Agathon sp.A
- Family Ceratopogonidae
- Family Chironomidae
  - Subfamily Tanypodinae
    - Ablabesmyia sp.A
    - Clinotanypus sp.A
    - Cryptocladius sp.A
    - Procladius sp.A
  - Subfamily Chironominae
    - Chironomus sp.A
    - Cryptochironomus sp.A
    - Microtendipes sp.A
    - Paralauterborniella sp.A
    - Rheotanytarsus sp.A
  - Subfamily Diamesinae
    - Diamesa sp.A
    - Pseudodiamesa sp.A
  - Subfamily Orthocladiinae
    - Brillia sp.A
    - Cardiocladius sp.A
    - Cricotopus sp.A
    - Eukiefferiella sp.A
    - Metriocnemus sp.A
    - Orthocladius sp.A
    - Trichocladius sp.A
- Family Empididae
  - Hemerodromia sp.A
- Family Rhagionidae
  - Atherix variegata Walker
- Family Simuliidae
  - Simulium sp.A
- Family Tanyderidae
  - Protoplasa fitchii O.S.
- Family Tipulidae
  - Dicranota sp.A
  - Hexatoma sp.A
  - Holorusia sp.A
  - Tipula sp.A

Order Acari
- Suborder Prostigmata

Phylum Platyhelminthes
- Class Turbellaria
  - Family Planariidae
    - Dugesia sp.A

Table 8 Continued

Phylum Annelida
Class Oligochaeta

Phylum Mollusca
Order Basommatophora
Family Lymnaeidae
Lymnaea sp.A
Family Physidae
Physa sp.A
Family Planorbidae
Gyraulus sp.A
Family Ancylidae
Ferrissia sp.A
Order Eulamellibranchia
Family Unionidae
Lampsilis siliquoidea (Barnes)
Order Heterodonta
Family Sphaeriidae
Pisidium sp.A
Sphaerium sp.A

Yellowstone River at Livingston

Table 9. Preliminary results of macroinvertebrate sampling on Yellowstone River (percent composition, all samples).

STATION	TAXONOMIC ORDERS					NUMBER SAMPLES ANALYZED TO DATE
	EPHEMEROPTERA	TRICHOPTERA	PLECOPTERA	DIPTERA	OTHERS	
1	27	30	3	40	< 1	3
2	52	14	15	19	0	2
3	28	7	1	64	< 1	3
4	38	5	11	46	< 1	3
5	25	58	12	5	0	3
6	67	10	5	18	< 1	3
7	49	10	6	32	< 1	2
8	48	27	9	16	< 1	2
9	67	15	7	11	< 1	10
10	20	1	1	78	< 2	4
11	20	20	2	58	0	4
12	11	11	1	77	< 1	2
13	86	0	7	7	0	1
14	88	2	6	4	0	1
15	51	7	8	33	< 1	1
16						0
17	36	28	5	31	< 1	7
18	24	3	8	54	11	1
19	26	39	7	38	0	2
20	75	10	0	8	7	1
MEAN =	44%	16%	6%	33%	1%	

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